JMEPEG (2014) 23:1513–1514
DOI: 10.1007/s11665-014-0994-8

1059-9495/$19.00

GUEST EDITORIAL

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This special issue of JMEP contains a collection of selected papers presented within the Topic *Joining and Interface Design* of the European Congress on Advanced Materials and Processing (EUROMAT), held in Sevilla (Spain) on September 8-13, 2013. EUROMAT conferences are held under the umbrella of European Federation of Materials Societies (FEMS) every 2 years since 1989 and have become one of the biggest and most lively meetings of the European Materials Science and Engineering (MSE) scientific community. EUROMAT 2013 with 22 sessions on various topics in MSE attracted over 2000 delegates from countries all around the world.

The Topic *Joining and Interface Design* within the Processing Area brought together about 150 participants who shared new developments and experiences in the continuously advancing field of materials' joining. Besides the traditional symposia on *Wetting* and *Joining Technologies*, a first symposium on *Interface Design*, focused at interdisciplinary approach to multi-phase materials, was integrated within the topic. The speakers reported many interesting scientific results and new technological developments in the field, raising inspiring discussions and lively exchange of ideas.

Joining is a key technology for the fabrication of multi-phase and multi-component assemblies for automotive, aerospace, building, energy, electronics, and other industrial sectors. Nearly all of our daily products contain joints between different materials. Driven by their increasing performance requirements, which cannot be fulfilled by a single material or component, the importance of the joining technologies is still growing. However, the "high-end" joint performance is only one of the challenges the joining community is facing today. The possibility of joining advanced materials with ultrafine or nano-engineered structure, as well as the broad variety of materials and miniaturized components integrated in joint assemblies, represent additional technological challenges. These challenges can only be met by gaining comprehensive fundamental understanding of the delicate interplay between the various phenomena that govern the joining processes, such as (inter-)diffusion, wetting, melting, and phase transformations. On this foundation, new (nanostructured) joining materials and joining processes can be developed through smart engineering of internal interfaces at the different length scales.

Introduced by an historical overview on the *Joining and Interface Design*, the papers presented here mirror all these scientific problems and range from the basics of interfacial reactions at the nano- and micro-scale to processing and joint performance issues at the macroscale.

The reader will find communications on the most recent advancements related to *wetting* phenomena at medium and high temperatures, from basic studies to applications. The solid-liquid and solid-solid interactions and processes related to wetting are reported for different materials combinations and various joining processes with special emphasis on the importance to control wetting phenomena and interfacial interactions to optimize the reliability and sustainability of the joined assembly.

Interface design is crucial for the joint performance and, at the same time, offers a powerful parameter for the microstructural engineering of new solder and brazing filler materials and coatings for joining of miniaturized functional components, nano-materials, and heat-sensitive components. Experimental investigations of the interfacial phenomena, model predictions of size-effects in nano-structured materials and joining processes using nanomaterials (e.g., reactive nanofilms) are reported.

Finally, recent advances in *joining technologies* as soldering, brazing, diffusion bonding, transient liquid phase bonding, welding are presented together with the evaluation of the mechanical, thermal, corrosion and wear resistance joint properties and the resulting application opportunities.

We wish to thank the Conference Chairs, Prof. Paloma Fernández and Prof. Frank Mücklich, for the organization of this excellent event of high-scientific quality. We address our deep gratitude to Prof. Rajiv Asthana, JMEP Editor, and Diane Whitelaw, Production Coordinator, as well as to the team for the very efficient, professional, and friendly support and for the opportunity to expose this research area to a larger public. We are greatly indebted to the manuscript authors and reviewers for their contribution to the successful completion of this special issue.

As intensively discussed during the symposia and indicated in some of the papers, many questions in this field remain still open and need to be clarified to ensure a successful technological transfer in the near future. However, the industrial need for the joining related solutions is tremendous and the scientific issues behind the problems to be solved are fascinating. It is our hope that this special issue will stimulate the scientific discussions and co-operation between experts of different background and origin to accelerate the understanding of the joining related phenomena to offer solutions according to the industrial needs.

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